RTCA

THE GOLD STANDARD FOR AVIATION SINCE 1935

Approved by the NextGen Advisory Committee October 2016

Joint Analysis Team: Performance Assessment of North Texas Metroplex and Established on RNP in Denver

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Report of the NextGen Advisory Committee in Response to Tasking from the FAA

October 2016

Joint Analysis Team: Performance Assessment of Metroplex and EoR

Contents

Introduction/Background

The NextGen Advisory Committee (NAC) has been instrumental in helping the Federal Aviation Administration (FAA) move forward with NextGen implementation. In 2014, the Committee approved a recommendation for a set of integrated plans on four focus areas of NextGen capabilities (DataComm, Multiple Runway Operations, PBN, and Surface).

These plans were developed by a joint FAA-Industry team, the NextGen Integration Working Group (NIWG), operating under the NAC. The goal of the NIWG is to identify implementation priorities that deliver measurable benefits by certain dates, and, thereby, increase the community's confidence in NextGen.

In June 2015, the NAC considered and approved six high level performance metrics intended to measure performance impacts attributable to the deployment of the four key NIWG capabilities outlined in the "NextGen Priorities Joint Implementation Plan" of October 2014. The set of metrics are intended for the FAA and industry to collaboratively monitor performance to understand the impact of implementations. The six metrics (detailed in Appendix B) are:

1. Actual Block Time
2. Actual Distance Flown
3. Estimated Fuel Burn

} Measured by city pairs

4. Throughput – Facility Reported Capacity Rates
5. Taxi-Out Time
6. Gate Departure Delay

} Measured at airports

Subsequently, the NAC formed the Joint Analysis Team (JAT) which includes operational and analytical experts from the FAA and industry. The JAT was formed to reach a common statement of fact regarding performance impacts and benefits that can be attributed to implementation of NextGen capabilities. To accomplish this goal, the JAT has analyzed data, metrics, methods and tools typically used by each of the parties in this type of assessment. This has included analyses of other measures deemed appropriate beyond the six metrics noted above. Additionally, the industry, through RTCA, selected PASSUR Aerospace to provide a database and associated analytical capability to track performance of these six metrics.

The JAT's scope involves evaluation of the following capabilities at the following locations:

- Wake ReCat Implementations at Charlotte Douglass International Airport (CLT) and two Chicago area airports – O'Hare International Airport (ORD) and Chicago Midway International Airport (MDW)
- Performance Based Navigation (PBN) Metroplex Implementation in North Texas
- PBN Established on RNP (EoR) in Denver International Airport (DEN)

This report includes findings on North Texas Metroplex and Denver EoR implementations. Findings on Wake ReCat implementations were provided to the NAC in June 2016.

Methodology

The JAT is comprised of data and analysis experts from the FAA as well as the aviation industry, and the team conducted a series of meetings to discuss and review ongoing analysis. This team initially agreed by consensus on methodologies to evaluate the impacts of Metroplex and EoR. A subset of team members then utilized their own company data to assess Metroplex and EoR using these methodologies. Data from the FAA, MITRE, American Airlines and Southwest Airlines were utilized in this process. Team members utilized the agreed-upon methodology and different data sources to analyze the impacts and benefits of Metroplex and EoR. The JAT utilized these analysis results to document agreed upon findings that follow in this report.

The working dynamic between the FAA and industry team members remained a positive and professional one in which capable analysts from different perspectives challenged one another's perspectives. The final product of this body is the result of strong collaboration and sharing of data and ideas between the FAA and industry. The JAT built trust and confidence amongst members throughout the process.

Summary of Findings

Established on RNP (EoR) in Denver

- EoR increased utilization of RNP AR approaches from 5.8% of arrivals to 6.6% of arrivals to Denver, an increase of 12%
  - Time saved from efficient approaches increased from 211 to 282 hours annually
- If an additional waiver is granted, EoR is expected to enable an increase up to 7.1% of arrivals executing RNP AR approaches.
  - Time saved expected to increase to 360 hours annually
- EoR is an important enabler to further future growth of utilization of efficient PBN approaches.

North Texas (NT) Metroplex

- Many external factors challenged pre vs. post Metroplex analysis
  - DFW/AAL re-banking, CRO, over-the-top elimination, Wright amendment at DAL, use of flow metering, change in wind patterns, and WN Cost Index change (speed increase)
- Changes in city pair block times driven by winds, not Metroplex
- The Team recognized the importance of system impacts of the Metroplex and, after analysis, determined to focus on flight trajectory changes within 300 nm as it best approximates effects of the North Texas Metroplex and allows for better isolating external factors pre/post implementation
- Metroplex has…
  - Segregated arrival routes between DFW and DAL

- Added route structure where flights previously vectored off-route
  - Enabler for increased TBFM forecasting accuracy, infrastructure for new tools and improved safety per SMEs
- Slightly increased flight distance within 300nm but slightly reduced time
- Clearly reduced level segments and increased continuous descents, particularly for DFW

Appendix A: Members of the Joint Analysis Team

Mike Cirillo, Airlines for America
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Thomas Carroll, Delta Air Lines
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Ken Speir, Delta Air Lines
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Leslie Higgins, FAA
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Kyle Smith, FedEx Express
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Ken Elliott, Jetcraft Avionics LLC
Lee Brown, Landrum-Brown
Mark McKelligan, NATCA
David Brukman, PASSUR Aerospace
Chris Maccarone, PASSUR Aerospace
Rob Golden, QED Consulting, LLC
Andy Cebula, RTCA, Inc.
Margaret Jenny, RTCA, Inc.
Trin Mitra, RTCA, Inc.
Bill Sperandio, Southwest Airlines
Tass Hudak, The MITRE Corporation
Bobby Kluttz, The MITRE Corporation
Pete Kuzminski, The MITRE Corporation
Debby Pool, The MITRE Corporation
Jeff Shepley, The MITRE Corporation
Marc Brodbeck, United Airlines, Inc.
Alex Burnett, United Airlines, Inc.
Glenn Morse, United Airlines, Inc.
Kevin Swiatek, United Parcel Service

Appendix B: NAC Performance Metrics

		Metric	Reported Values	Comments
Measured on applicable existing *104* city-pairs:	1.	Actual Block Time	Mean and std dev or 60% percentile	• Actual time from Gate-Out time to Gate-In time for a specified period of time by city pair • GA: IFR flight time from ramp taxi to ramp park
	2.	Actual Distance flown	Mean and std dev or 60% percentile	• Actual track distance between key city pairs for a specified period of time • GA: IFR flight distance from take-off to TOC & from TOD to touch down
	3.	Estimated Fuel burn	Mean and std dev	• Actual fuel burn for a specified period of time
Measured at applicable airports	4.	Throughput – facility reported capacity rates*	Mean and peak capacity rates	• Facility Airport Arrival Rates (AAR) & Arrival Departure Rate (ADR) Airlines (recommend: http://www.fly.faa.gov/ois however, the working group is open to alternate measurements that meet the requirements) • GA: measured as access events – Radar vector and not SID as OUT event and Ground based nav and not GPS / WAAS-LPV as IN event
	5.	Taxi-out Time*	Mean and std dev or 60% percentile	• Actual time from Gate-Out to Wheels-Off time by airport (minutes/flight) • GA: IFR flight taxi time from ramp taxi to take off
	6.	Gate Departure Delay	Delays/100 act depts. And total delay minutes	• Difference in actual Gate-Out time and scheduled Gate-Out time, Not measured for GA

* - Identified by FAA

1 GA data may not currently be collected

Appendix C: Detailed Methodology and Analysis of Metroplex and EoR

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Joint Analysis Team Report to the NextGen Advisory Committee

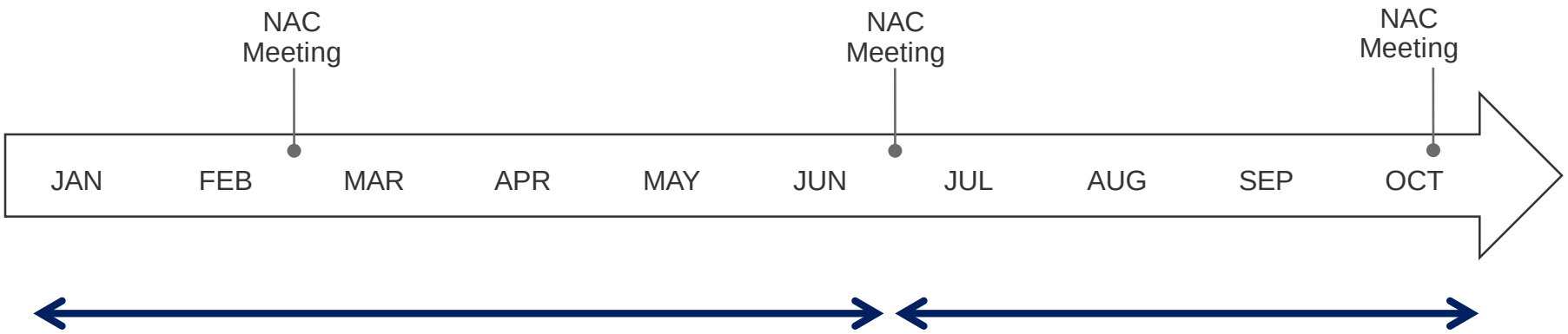
October 5, 2016

Ilhan Ince, American Airlines
Dave Knorr, FAA
Co-Chairs of the Joint Analysis Team

Joint Analysis Team (JAT)

- Goal: develop common statement of facts on NAS performance attributable to NextGen
- Analytical experts from industry and FAA. Participating organizations include:
  - Airlines 4 America
  - ACI North America
  - American Airlines
  - Cessna Aircraft Corp.
  - DFW International Airport
  - Delta Airlines
  - FAA
  - FedEx Express
  - JetBlue Airways
  - Jetcraft Avionics LLC
  - Landrum and Brown
  - MITRE
  - NATCA
  - PASSUR Aerospace
  - Southwest Airlines
  - United Airlines
  - UPS

JAT Schedule and Status



Wake ReCat Assessment

- CLT
- ORD/MDW

PBN Assessment

- Denver Established on RNP (EoR)
- North Texas Metroplex

FOCUS FOR TODAY

JAT Findings – Established on RNP

- EoR increased utilization of RNP AR approaches from 5.8% of arrivals to 6.6% of arrivals to Denver, an increase of 12%
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- If an additional waiver is granted, EoR is expected to enable an increase up to 7.1% of arrivals executing RNP AR approaches
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Annual Benefits from RNP AR with EoR

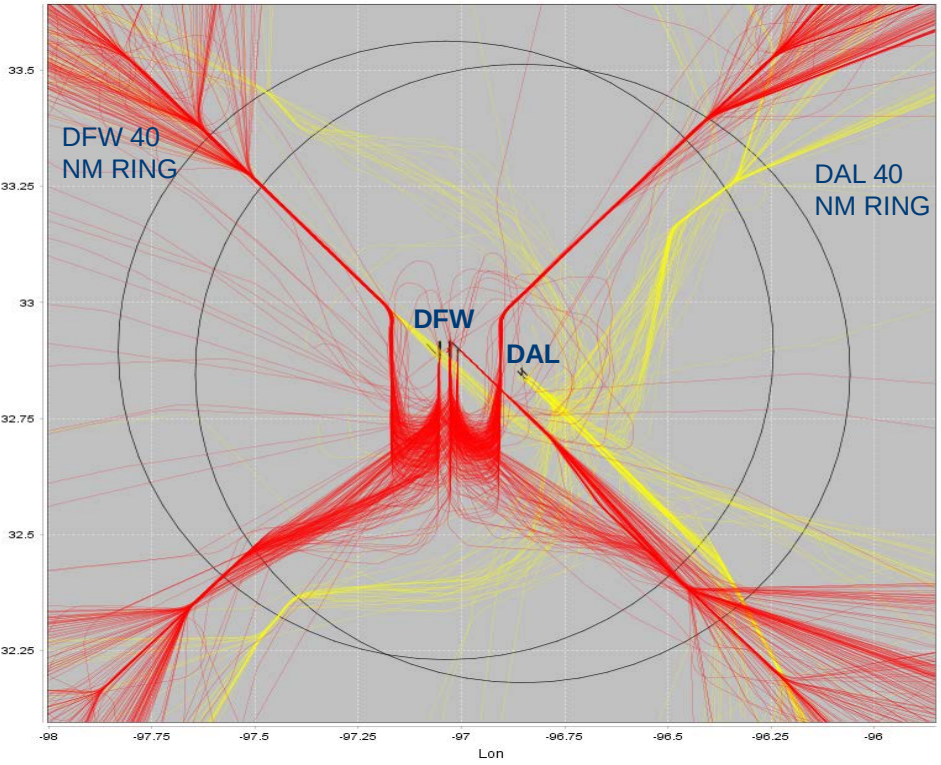
RNP AR benefit	RNP AR Pre-EOR	RNP AR with EOR	RNP AR EOR adjst IMC
Utilization (% of all arrivals)	5.8%	6.6%	7.1%
Avg. Distance Saving (nm/flight)	2.5	2.9	1.5 – 18.3
Overall Arrivals in 2015 (flights)		272,685	
Total Distance Savings (nm)	39,178	52,385	66,757
Avg. Speed at Intercept (kts)	185.3	185.6	185.6
Total Time Savings (hr)	211.5	282.3	359.7

Data Sources:
- ASPM, for annual arrivals and occurrence of IMC
- PDARS, for utilization, distance and time calculations

North Texas Metroplex

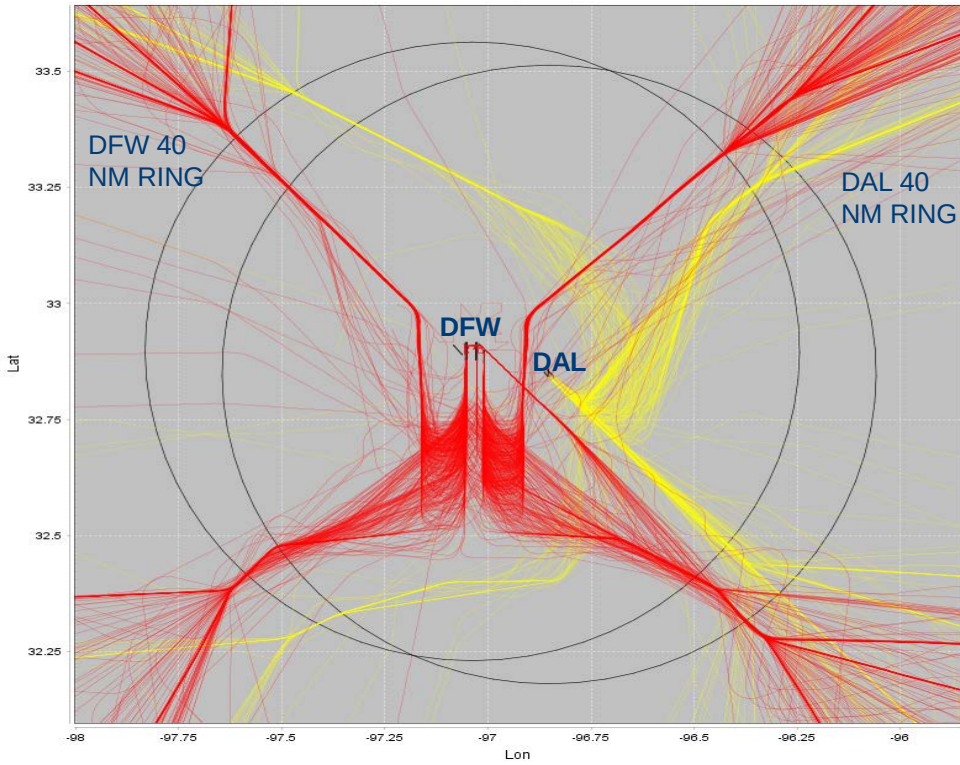
Pre Metroplex Arrival Flows

Oct 2013 – Feb 2014



Post Metroplex Arrival Flows

Oct 2015 – Feb 2016



JAT Findings – NT Metroplex (1 of 2)

- Many external factors challenged pre vs. post metroplex analysis
  - DFW/AAL re-banking, CRO, over-the-top elimination, Wright amendment at DAL, use of flow metering, change in wind patterns, and WN Cost Index change (speed increase)
- Changes in city pair block times driven by winds, not Metroplex
- Team recognized importance of system impacts of the Metroplex and, after analysis, determined to focus on flight trajectory changes within 300 nm as it best approximates effects of NT Metroplex and allows for better isolating external factors pre/post implementation

JAT Findings – NT Metroplex (2 of 2)

- Metroplex has…
  - Segregated arrival routes between DFW and DAL
  - Added route structure where flights previously vectored off-route
    - Enabler for increased TBFM forecasting accuracy, infrastructure for new tools and improved safety per SMEs
  - Slightly increased flight distance within 300nm but slightly reduced time
  - Clearly reduced level segments and increased continuous descents, particularly for DFW

Lessons Learned

EoR

- EoR, in conjunction with terminal sequencing tools and growing aircraft equipage, should further grow the percent of arrivals executing efficient PBN approaches

Metroplex

- Developed a robust Metroplex methodology that effectively accommodates for variety of pre/post implementation changes and may be used in future
- Additional work required: need to document the Metroplex analysis process and determine a joint approach to measure fuel impacts/changes
- Metroplex efforts should continue to ensure they are cognizant of impacts on flight time and distance